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SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 LEXINGTON AVENUE NEW YORK 17, N.Y.	AEROSPACE RECOMMENDED PRACTICE	ARP 816
PRESSURE FUELING SIMULATOR FOR EVALUATING AIRCRAFT FUEL SYSTEMS UNDER DESIGN PRESSURE FUELING CONDITIONS		Issued 6-20-64 Revised
CANCELLED 1. INTRODUCTION 1.1 The widespread use of pressure fueling equipment on modern aircraft permitting higher fueling rates has brought with it the problem of designing pressure fueling systems within the aircraft capable of limiting surge pressures developed by flow shutoff to acceptable values. It is recognized that both the ground fuel dispensing system and the aircraft's pressure fueling system participate in the development of surge pressure. The design of the pressure fueling system of the aircraft is, almost without exception, dependent upon the characteristics of the ground fuel dispensing system intended for use with it. Therefore, it is necessary that ground fuel dispensing systems adhere to some standard, regarding surge pressure development potential, and that aircraft be tested using such a standard dispensing system or suitable simulator in order to ensure that surge pressures developed within the aircraft's pressure fueling system are of safe magnitude. The state-of-the-art in the design of ground fueling systems and aircraft fueling systems indicates that if the combined ground and aircraft system is designed to limit surge pressures to 120 psi, it is possible to design practical aircraft systems to contain the remainder of the flow phenomena, such as proof pressure, shut-off levels, venting, etc. It is not the intent of this ARP to require the construction of a new facility, since most existing laboratory systems can be modified or adjusted to provide the necessary criteria. 1.2 In summary, ARP 775 provides a means of determining the surge creating characteristics, or potential, of all ground refueling systems and requires that these characteristics be adjusted to fall below a maximum level. The following procedure provides for a dispensing system equal to the worst allowed by ARP 775 and the subsequent testing of aircraft with the system. An aircraft thus tested will be satisfactory wherever refueled since it will have been proven to have acceptable surge pressures under the worst conditions that should be encountered in service use. AIR 74 provides considerations involved in adjusting an existing system to effect the surge creating potential required for this document. 2. SCOPE - This document defines the operating characteristics of a pressure fueling system that may be used to evaluate the ability of receiver aircraft fuel systems to satisfactorily limit fueling shut-off surge pressures under simulated maximum design conditions. 3. OBJECT 3.1 The object of this document is to state, generally, the procedure for construction, or modification, of an existing system and the testing of a ground fuel dispensing system simulator which can subsequently be used to test the pressure fueling system within aircraft for surge limitation capability.		

- 2 -

- 3.2 Generally, the test of the aircraft fueling system will involve use of the simulator to dispense fuel flow under pressure to the aircraft's pressure fueling system, shut-off of the flow by equipment elements within the aircraft's pressure fueling system, and measurement of the resultant surge pressure at various locations within the aircraft's pressure fueling system. The resultant surge pressures will need to conform to specified maximum permitted values as determined by applicable procurement specifications.
- 3.3 Where fuel level control valves within the aircraft are involved, and as a by-product of the surge testing, the ability of the aircraft system to control fuel level will be indicated.

4. APPLICABLE DOCUMENTS

- 4.1 ARP 775, "Test Procedure to Determine Surge Potential of Ground Pressure Fueling Systems"
- 4.2 AIR 74, "Considerations on Limiting Pressure Surge During Ground Pressure Refueling of Aircraft"

5. DESIGN REQUIREMENTS

- 5.1 The simulator shall consist of all of the necessary components to deliver fuel through one or more fueling nozzles at flows and pressures specified by the applicable aircraft model specification. All components shall be designed to adequately meet their requirements from a standpoint of strength, fuel resistance, size, attachments, etc., and shall possess performance capability commensurate with their required contribution to the overall system performance.
- 5.2 Instrumentation shall be provided to adequately measure the fuel flow rate, pressure, and other parameters required to describe the correct operation of the system in the particular aircraft under test. Since high frequency transients may be involved, instrumentation must be chosen with sufficient response rates.

6. PROCEDURE

- 6.1 Construct a ground, fuel dispensing system simulator employing the flow rates, steady pressures, and hose arrangement specified for the ground fuel dispensing system being simulated, which, when shut off at the servicing nozzle in prescribed fashion, will produce a specified surge pressure.
- 6.1.1 For general design considerations leading to such construction, see Sec. 3 of AIR 74, the documents listed in Sec. 4 of AIR 74, and other published works on the subject of water hammer, i. e., surge pressure. Sec. 3 of AIR 74 gives considerations leading to a "paper" simulator for study of hypothetical refueling situations. These considerations apply also to construction of a physical simulator.